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THE PRINCIPLES OF PHILOSOPHY.

BRITISH MUSEUM

THE

PRINCIPLES

OF

PHILOSOPHY.

'ΑΥΤΟΤ γαρ μαι ἐδωκε των ὀντων γνωσιν ἀψευδη,
εἰδεναι συστασιν κοσμου, και ἐνεργειαν στοιχειων.

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THE FIRST PRINCIPLES OF PHILOSOPHY.

THE philoſophers have been very curious and minute as to their enquiries into the mathematical laws and proportions of the motions of the larger bodies in this ſyſtem, which commonly go under the name of gravitation, attraction, projection, &c. But they ſeem to have been very unſucceſsful or defective, as to their diſcovering the natural or mechanical principles and cauſes of all motion in material ſubſtances. As local motion can belong only to material bodies, I am inclined to think it muſt be produced by material principles. The procedure of nature cannot be creating of new ſubſtances, but is a courſe of motions, revolutions, changes, alterations, and variations in matter already in being: ſo that this univerſal frame ſeems to be nothing but a complicated train of motions, abſolutely depending upon the immutable conſtituent properties of matter. In a word, the principles of matter and motion ſeem to be one and the ſame. Therefore it is hoped the following Eſſay to ſtate the firſt principles of natural philoſophy will meet with a candid and open reception from the public in general, as it is no way abſtruſe, and from the ſearchers after phyſical truth in particular, as I hope they are agreeable to the profound ſimplicity of nature, and the mechanical juſtneſs of all her operations.

The univerſe appears to be one great machine, fitted and diſpoſed to perform all the operations which are carried on throughout the whole. No one part of it ſhould be conſider'd as acting, without being acted upon, and no individual can be conſider'd as an agent, without being a patient. It is unphiloſophical to ſay, matter in general, or any part of it, has eſſential or ſeparate properties, by which one part acts upon another: it is the eſſential property of no one wheel in any machine to move its fellow, though in conſequence of its being placed in the ſtation it is fitted for, it acts upon its fellow, becauſe it is acted upon.

Juſt ſo it is with the whole ſyſtem of nature. You cannot take up any parcel of matter and ſay of it, This has eſſential ſeparate properties, which impower it to be a natural agent. A philoſopher ought to conſider it as a concrete, with a certain diſpoſition of its parts, liable to be acted upon by the ſubtiler parts of the machine, which cannot be reſtrained from it by art. And it may as juſtly be alledged, that it is the eſſential property of animal ſubſtances to live, or of vegetables to ſpring, as it can be ſaid, that it is the eſſential property of the loadſtone to attract. Nothing therefore can be more conducive to the promoting a true acquaintance with the operations of nature, than to conſider what are, and what are not the eſſential properties of the firſt principles of matter.

Firſt then, matter muſt be compoſed of firſt principles: and theſe may be called units or atoms of matter. Nothing to me appears more ſceptical in philoſophy, than to aſſume it for a firſt principle, that matter is infinitely diviſible. Which is aſſerting in other words, that matter has no beginning of ſubſtance---that there are no limits between matter and nothing—that there cannot be ſuch a thing as an unit of matter, is to maintain, that matter has an infinite property. To ſay that any parcel of matter is finite, and at the ſame time that its component parts are infinite, is indeed philoſophy baffling itſelf, and maintaining contradictions. Time is made up of a perpetual ſucceſſion of years and days, and is meaſured by hours and minutes, and moments. And it would be juſt ſuch a metaphyſical truth to tell us, one moment of time may by dividing be lengthen'd out into a thouſand ages, as it is a phyſical truth to aver, that a grain of ſand, by the infinite diviſibility of its matter, may be rarified and enlarged unto the bulk of a planet. Nothing can be more ſhocking to reaſon, or even to the ear, than *Eternal Time*; and infinite diviſibility when examined muſt be found juſt as abſurd. Concretes, in which form matter is made ſubject to our ſenſes, can no more be without ſuch firſt principles, than numbers in arithmetic can be compoſed without units.

2. Atoms muſt originally ſubſiſt in numbers, which cannot be diminiſhed or encreaſed; it is equally impoſſible for many to become one, as it is for an unit to be multiplied: ſo that the original num-

ber of atoms is as invariable as their figures, or ſizes. An atom may as ſoon be repreſſed into nothing, as two can be made to coaleſce into one unchangeable ſubſtance. Number is the fundamental baſis of motion and changes in matter. An atom cannot act upon itſelf, nor communicate action, impreſſed intimately to its ſubſtance though never ſo large, but a concrete can and does impreſs its own inward parts in a mechanical proportion to the power which acts upon its ſurface. Therefore it is in vain to ſay, that all atoms muſt have parts, tho' the component particles of all bodies are ſmall enough and rigid enough to reſiſt or elude all ſeparation by the agency of matter. If any body though never ſo ſmall has numerical parts, their coheſion muſt be mechanical, and nature can do nothing but what it can undo again, under certain circumſtances. To this purpoſe, Sir Iſaac Newton cloſes a fine enquiry into the nature, laws, and conſtitution of matter:— "All "theſe things conſidered, it ſeems proba- "ble to me, that God in the beginning, "created matter in ſolid; maſſive, hard, "impenetrable, moveable particles,— in- "comparably harder than any of the po- "rous bodies compounded of them: nay,

" ſo hard as never to wear, or break in
" pieces; no human power being able
" to divide what God made one at the
" creation. While theſe particles continue
" intire, they may compoſe bodies of one
" and the ſame nature and texture in all
" ages: but ſhould they wear away, or
" break in pieces; the nature of things
" depending on them, would be changed;
" water and earth compoſed of old
" worn particles, and fragments of particles
" would not be of the ſame nature
" now, as water and earth compoſed of
" intire particles at the beginning. And
" therefore that nature may be laſting,
" the changes of corporeal things are to
" be placed only in the various ſeparations,
" and new aſſociations and motions
" of theſe permanent particles.*"

3. Such an atom or unit of matter muſt have dimenſion; it conſtitutes its own ſpace wherever it is, and occupies it. The idea of a ſolid and extenſion are inſeparable; but that of diviſion and a ſolid are irreconcileable. Solidity among concretes is only comparative and imperfect, but it is as great a contradiction in terms to apply diviſion to a proper ſolid, as it is to apply it to the ſpace of a body abſtractedly or

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* Newton's Optics.

mathematically cnnſider'd, which is nothing. Though two things may be ſeparate one from another, yet one thing and nothing are equally indiviſible. Dimenſion in bodies has proportion, and may be conſider'd leſs or more; and the extenſion of a larger body may be a proportion for ſeveral ſmaller bodies: but the idea of parts and diviſions, has no connexion with extenſion, and as little with the matter which occupies it, unleſs it is a concrete. Diviſion, is an idea which properly belongs to number, which is a conſequence of the exiſtence of matter, and a different one from ſpace. There is therefore no connexion between matter having dimenſion, and its conſiſting of parts; or one body is not many in reſpect of another of the ſame kind, becauſe its ſubſtance is larger. To take an example from units of concretes, of which nature is compoſed in a ſecondary ſenſe; one egg may be larger than another egg; but though the one may be thrice as large as the other, yet the bigger is as much one as the leſſer, and cannot be ſuppoſed to be three. There is a great difference between thrice as much matter being contained in one individual more than there is contained in another individual, and the larger one's being three individuals. Juſt ſo it is with reſpect to the firſt order of units, or the atoms of which all concretes muſt be compoſed. One atom may be ſeveral times larger than another atom, yet it is as much an unit as the other, and cannot be divided; though if any one pleaſe he may conceive of its dimenſions as having diſtinct room for a concrete of ſeveral ſmaller atoms; but even that gives the extenſion of the large atom no parts further than by ſuppoſing a body with parts to occupy its place. Now becauſe the larger atom is ſeveral times more extended than the atoms of a concrete of its ſize, the one atom is not therefore many, becauſe the concrete is ſo. Therefore every atom or unit of matter has extenſion, which we may ſuppoſe to have menſurable proportion, but the atom itſelf is incapable of diviſion, becauſe

4. An atom does not conſiſt of parts. It is not compoſed by one body's being applied to another body, which either art or nature can ſeparate, or which can be ſeparated even in *Imagination*. There can be no encroaching on its ſubſtance but by annihilation. Though we ſhould ſuppoſe two bodies equal in ſize, the one a concrete, the other an atom; becauſe

the concrete may be diſſolved into a thouſand inconceivably ſmaller parts, yet that can give us no idea of the atom's conſiſting of as many parts ſtrictly applied to one another. It is an atom, has no coheſion of parts, becauſe it has no parts, however conſpicuous its dimenſions may be, yet it is one and unalterably the ſame. What gave being to it in that ſize and form can only alter it. But nature, or matter acting upon matter, combining, diſſolving and changing the forms of things, cannot change an atom.

5. An unit of matter cannot be pervaded. Its ſubſtance is without parts, and ſo without pores or interſtices. It can be pervaded by no fluid, though never ſo ſubtil. It occupies its own ſpace or dimenſions, and nothing elſe can be ſaid to be or exiſt where it is. Pores or interſtices belong only to concretes, or atoms forming a maſs by adhering to one another in any number. Such concretes as theſe muſt have interſtices between their atoms, and may be allowed to have theſe interſtices filled with a ſubtil fluid; or if there is any neceſſity for ſtill retaining the paradox, may have ſpace occupying them, as well as they occupying ſpace. But this cannot be the caſe of an unit: ſo far from it, th

ſpace or dimenſion is an eſſential property of matter; and it is impoſſible to have any conception of the two ſeparately.

6. Every unit, in conſequence of its former conſtituent properties enjoys perfect ſolidity. Atoms of one ſhape and ſize cannot be heavier than one another. Weight, ſubſiding, aſcending, and parcels of matter taking different ſtations of one another, or weighing differently, are the effects of matter acting upon matter, and are performed according to the laws of different ſolidity, *&c.* Which ſubſiſt not among atoms, further than as to their different ſhapes and ſizes, by which another material agent may be applied to them in different proportions. But matter ſubſiſting in atoms, and acted upon by the agent which produces gravitation, would precipitate or ſubſide equally, becauſe in units there can be no difference of ſolidity. Atoms of the ſame figure and ſize, or of different ſhapes and ſizes, muſt be to one another, as gold is to gold, and not as gold is to ſilver, or any other metals which differ from one another in their ſpecific gravities.

7. Such atoms muſt be abſolutely opaque. Pellucidity is oppoſite to perfect ſolidity, and ſuppoſes interſtices, and theſe

in a certain direction. The tranſmiſſion of light in direct lines through the pores of concretes is ſuch a ſingular conformation of its ſolid parts and interſtices as deſerves a ſeparate treatiſe; but atoms have no pores, ſo nothing can penetrate their ſurface. And when reflexion of light is ſufficiently underſtood, it may be conſidered, whether atoms ſubſiſting as ſuch (that is, not adhering in forms) could in any quantity become viſible.

8. Atoms are abſolutely inert, and can neither conciliate motion to themſelves, nor continue in motion longer than they are impelled. They are abſolutely paſſive, and cannot be ſuppoſed to move one hair's breadth after the impelling force is reſtrained. To give matter an eternal power of changing its place in conſequence of its being once diſquieted, to me appears moſt unphiloſophical.

9. Units are at the ſame time capable of perfect mobility. For as they cannot move themſelves, or alter their place; ſo they have in themſelves not the leaſt reſiſtance to motion, or to be continually altering their ſtation while they are impelled. Therefore, in our ſyſtem the matter which ſubſiſts without any coheſion

of its atoms muſt be by far the moſt active.

10. Atoms can have no elaſticity. They have no parts to recoil, and to reverberate upon their being impelled. That property of matter implies parts, interſtices; theſe interſtices repleniſhed with ſome active fluid, and a reſiſtance to motion: none of which atoms have.

11. Atoms can have no attracting or impelling powers, *&c.* To ſuppoſe them to have ſuch, is to deſtroy another property, which by the philoſophers is aſcribed to matter; namely, the *Vis Inertiæ.* For if the firſt principles of matter attract one another, that is endowing them with a *Vis Motus*, or a power of moving towards one another. If ſuch a thing there be as attraction, it muſt be either a material property, or a ſpiritual one. If it is a material one, an atom cannot be poſſeſſed of it. It cannot move itſelf. It conſiſts of no parts, therefore cannot detach ſubtiler parts to draw its fellows into contact. If it is a ſpiritual operation, then it is no property of matter at all. And if the firſt principles of motion in matter be univerſally ſpiritual, then there is no need for mechanical agency in

matter, or of ſecond cauſes. If we ſay, there is uſe for mechanical agency in nature, then it is very abſurd in philoſophers to fix unmechanical principles, until they are certain and can demonſtrate, that they have traced the utmoſt length that nature in a mechanical way can go. If attraction be a principle or radical property of matter, how is it, that it can be weakened, ſuſpended for a time, yea and quite deſtroyed? If it be a power determining matter to matter, and as real a property of matter as ſolidity, *&c.* How is it that this property can be overpowered and deſtroyed by matter's acting mechanically upon matter, which muſt always be in a conſiſtency with and ſubſervience to its original properties? Yet in fact we ſee the force of fire can ſuſpend the ſtrongeſt attractions, as in the fuſion of gold, when that metal which has ſuch ſtrong attraction of its parts appears in the form of that metal which has the leaſt and weakeſt of any, namely, Quickſilver.

12. Neither can the firſt atoms of matter poſſeſs a power of gravitation. That principle is yet more oppoſite than the former to a *Vis Inertiæ*; and the laws of gravitation and attraction ſeem even di-

rectly oppoſite to one another. In attraction that power is weak enough not to exert itſelf, but when the atoms of matter are in immediate contact with one another, or are at leaſt verging upon it; yet when they thus approach one another they acquire an obſtinate coheſion. On the contrary, matter attracts matter in gravitation at infinite diſtances; and that paſſion encreaſes their velocities the nearer they approach one another: yet when they come into contact, notwithſtanding the rapidity with which they ruſh towards one another, they acquire no adheſion at all. One who would conſider theſe two diſpoſitions of matter (if ſuch there be) in a natural way, would think that the one would naturally paſs into the other, and that they both proceeded from the ſame inclination; ſo that gravitation would naturally end in that adheſion, which is the effect of attraction. But it is not ſo. From all we can underſtand of the units of which matter is compoſed, a maſs of them, lying together, unacted upon by a mechanical material agency, would neither attract, gravitate, nor take place of one another, as in our ſyſtem bodies of different gravities do.

13. Units may differ from one another in their ſize. This property it is which lays the foundation for all the variety of forms and diverſity of ſubſtances with their ſingular properties when thus combined, which are ſo uſeful in the univerſe. This property, I ſay, is the ſource of all that variety when joined with

14. The diverſity of figures in original atoms. Theſe two modify the other general properties of matter, ſo as units combined according to their different ſizes and figures, preſent us with that profuſe and beneficial variety of ſubſtances, which we ſee in the creation. Without theſe it will be difficult to account for them. Theſe leave ſmall hopes of the tranſmutation of metals, *&c.* eſpecially the more pure and ſimple ones. For if the units of gold, ſilver, or quickſilver be eſſentially different in their ſizes or figures, or in both of them, no art or mechanical agency can change the units of matter, becauſe all the properties of atoms are.

15. Unchangeable. To alter an eſſential property of any atom is to annihilate it, and ſo to diſannul its properties altogether. This is a firm baſis for mechanical agency. For if the ſubſtance of the firſt principles of matter were not permanent

in its properties, but mutable upon external impreſſions, nature would go on uncertainly in her operations, and could not be uniform in her effects. Therefore we have no reaſon given us to apprehend, that matter has any primordial principles, which will yield to external agencies. An atom and all its properties are coeval, and muſt be of equal duration; becauſe an atom and its properties are the ſame. We can have no apprehenſion of matter but that it is ſubſtance: and if we would define ſubſtance, we have no characteriſtic of it, but its properties. Therefore to give matter properties which can be diſſolved by any agency, beſides that by which it exiſts, is to leave us no certain principles as to matter at all. And hence we muſt neceſſarily conclude likewiſe that

16. All the properties of matter are material, and not ſpiritual. If the contradicting the former diſannuls all certainty as to matter itſelf, the denying of this would leave us in equal uncertainty as to its operations. To endue matter with properties which do not neceſſarily depend upon its being ſubſtance, is to poſſeſs it of a ſoul and ſpirit. And to ſubject ſoul, or theſe ſpiritual properties, to the laws of material mechaniſm is abſurd.

Nature proceeds mechanically ſo far as we can trace it, and though our ſenſes are limited as to the minutia of that mechaniſm: yet we are certain that matter does exiſt in ſuch forms in the univerſe, as will aſſure us the mechaniſm may go on further than we can deſcribe.—Matter is a mechanical and ſo a neceſſary agent: this we ought to call nature. But a ſpirit is a voluntary and ſo a free agent; and theſe ought not to be confounded. The philoſophy of occult qualities in matter, and of properties we have names for, but can form no ideas of, from the knowledge we have of ſubſtance, is certainly refined upon, by introducing the immediate agency of a firſt cauſe in all theſe caſes. This has lately been advanced by a great prelate and an ingenious philoſopher. And to be ſure it cannot be contradicted by any who maintain theſe uninveſtigable qualities of matter. But I cannot think it is doing any honour to the Deity, to make him a neceſſary agent in the courſe of nature, by impoſing theſe laws upon him, before we are certain whether material mechaniſm reaches unto them or not. Voluntary and neceſſary, are the diſtinguiſhing characters of the agency of ſpirit and matter: and to confound their operations is exalting the one and debaſing the other unduly.

17. All the properties of matter are natural, every one of them fit to act and to be acted upon in a mechanical way. They are ſuch as can all of them be adapted to the known principles of mechaniſm among artiſts. Latent qualities are deſtructive of that ſort of agency. Though matter is not infinitely diviſible, yet it is certain, its primordial atoms are indefinitely ſmall, ſo as the groſſeſt of them, are far beyond the reach of our ſenſes, even with all the aſſiſtance which art can furniſh them. At the ſame time our organs are ſo finely machined as to be ſubject to the impreſſions of the ſmalleſt: from which ſeveral uſeful corollaries might be deduced.—But becauſe the units of matter are ſo ſubtil as to elude our ſenſes, it does not therefore follow that we can have no certain knowledge of them, or of their properties. From the knowledge of concretes we may certainly diſcover, what are the general unvariable properties of their conſtituent atoms. Every concrete enjoys two diſtinct kinds of properties, the firſt are ſuch as are inſeparable from it as matter, and theſe properties belong to every atom of which a con-

crete is compoſed: the ſecond are ſuch as are naturally produced from matter being variouſly combined in concretes. Theſe are the natural, mechanical, or conſequential effects of the original properties of atoms adhering in various forms. Theſe cannot be however the original properties of matter, though the original properties being all mechanical naturally produce them. Therefore we ſhould obſerve the ſtricteſt caution leſt we aſcribe the different properties which matter acquires by being compoſed in different forms unto the firſt atoms themſelves: for one may as juſtly conclude, that the units of which ivory are compoſed are white, as that they are elaſtic.

THESE being the fundamental principles of matter, if we would underſtand the nature of its operations, we muſt proceed ſtep by ſtep, examining the different conditions in which it ſubſiſts in the world: What are the diſtinguiſhing characters of it in its different forms: How motion is produced and ſupported: What are the different circumſtances requiſite to produce, maintain and direct the motions of bodies: What is done upon their ſurfaces: What is a doing within them, or what it is they are ſaid to do conſidered as unorganized: What matter performs, and by what agents in organized bodies, and how far its powers extend in ſenſitive ones. But what I have ſaid above is ſufficient for my preſent purpoſe, if it eſtabliſhes the neceſſary inſtruments for ſupporting and maintaining that inimitable ſeries of variety, which nature diſplays in her operations, which is amazing unto all, and which it is the wiſdom of the true philoſopher to underſtand. All our enquiries are into the agencies of nature, but we can never comprehend them, unleſs we are acquainted with the principles which alone can produce them.

THE END.

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